FISHLIFE

Part 3 in a series about inshore fish of Hawaii. The 12-part series is a project of the **Hawaii Fisheries Local Action Strategy**.

TOPIC FECUND FEMALES

Photo: NOAA

WHEN THE FAT LADY SPAWNS, EVERYBODY WINS

BY SCOTT RADWAY

UNIVERSITY OF HAWAII PROFESSOR CHARLES BIRKELAND REVEALS A POWERFUL SLIDE EARLY ON IN HIS PRESENTATION ABOUT THE IMPORTANCE OF BIG FEMALE FISH.

Birkeland is talking to a crowd gathered at Bishop Museum about the practice of taking the largest fish from a fishery and allowing the younger fish to grow. But when it comes to egg production, he says, that might be counterproductive.

His slide shows an image of one 28-pound Caribbean snapper in one column and 212 images of 2.4 pound fish in the other column. His point is that the one big fish produced as many eggs as the 212 small fish. In other words, a boat full of 500 pounds of small fish would not deplete the next year's spawning any more than taking just one big snapper.

His point is not all fish are created equal.

There are other similar examples from Hawaii. Take the omilu, or bluefin trevally. One 27-inch omilu produces as many eggs as 86, 14-inch omilu. In hard numbers, that 27-inch omilu produces 4.3 million eggs, while each 14-inch fish produces 50,000 eggs.

Then consider it takes five 7-inch u'u to produce as many eggs as an 8.5 inch u'u.

"Older female fish produce exponentially more eggs," Birkeland says.

One simple reason for that fact is as fish grow in length they also grow in height and width. So the pouch they carry their eggs in is growing in three dimensions, which means it can carry a lot more eggs. Any fisherman who has cut open a big, gravid female fish has witnessed that productivity.

But the productivity of large female fish goes beyond that simple explanation. Ellyn Tong, of the Pacific Fisheries Coalition, explains that as fish get larger they have to expend less energy running away from

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As fish get larger they have to expend less energy running away from predators and can spend more energy on egg production. That means exponentially more eggs and healthier eggs.

- Take the omilu, pictured here: A 27-inch omilu produces 4.3 million eggs, while a 14-inch omilu produces 50,000 eggs.
- Most fish release their sperm and eggs into the water where they mix and typically drift out to sea so reef critters don't eat them.
- Though safer, the open ocean has less food and the more fatty eggs of an older female fish can provide nourishment for a larvae to survive long enough to find a meal.
- On average one out of 250,000 fish larvae makes it to adulthood. That's why so many eggs are needed to maintain a healthy fishery.

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What happens if we fish out all the large, fast-growing fish of a species and only the small, slow-growing fish are left to reproduce?

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In addition, the larger fish can swim further and can eat more diverse food and larger food. Studies have found that the eggs of big females are, in addition to being more numerous, healthier and contain more fat to help larvae survive the early days in the open ocean, Tong says.

Tong explains that most fish are broadcast spawners, meaning they release their sperm and eggs into the water where they mix and typically drift out to sea so reef critters don't eat them. That's why fish often spawn during spring tides so the eggs will be sucked out to sea. But the flip side of the coin is the open ocean has less food availability and a more fatty egg can be the deciding factor in whether a larvae lives long enough to find food.

"Larvae can live for weeks, sometimes months in the open ocean," Tong says. "They go out and search for plankton to feed on. That's why baby fish have such bigs eyes and mouths."

And survival is the name of the game.

"One out of a 250,000 make it to adulthood," says Tong. "When that fish makes it back to the reef and then later adulthood, it is a survivor. It has done something tens of thousands of its brother and sisters weren't able to do. There are few creatures that have such a low make it rate."

So the number of eggs and health of the eggs increase the odds. Birkeland says another impact of fishing out the large fish is also removing the fish in that species that genetically grow fast. As a result, the fish that grow slow, the runts, become the bulk of the gene pool and over time, the size of the fish is reduced.

"Runts beget runts," Birkeland says.

In addition, if the fishing pressure is removed, the remaining gene pool is the relatively small fish, so reversing the trend becomes much harder. "Many fish are losing the capability to grow big," Birkeland says.

Another issue is that many fish change sex over their lifetime. For example in the case of moi, or Pacific threadfin, the fish becomes female at around 16 inches. If you fish all the big moi, then there aren't any females to reproduce.

Management policies have to date concentrated more on the small fish, with the intention of letting them grow enough to reach sexual maturity. Most size minimums are set at the size that half of the fish have reached sexual maturity. But some regions are discussing also limiting taking large fish and creating a slot of sizes in between that can be taken. That way you make sure there are enough large fish to produce eggs and enough fish are reaching sexual maturity.

"You need to give them a chance to reproduce or the population isn't going to last long," Birkeland says.

Photo: Octavio Aburto

GETTING TOGETHER: For a healthy fish population, the fish of course need to get a chance to reproduce each year. That also means letting some of the big fish survive because they are the most productive when it comes to spawning.

RUNT OVER

The way Westerners have generally managed fish is allowing the small ones to grow big enough to spawn, while taking the big ones to eat. But the problem with reef fish is the largest ones are the ones that provide most of the eggs for spawning. (They evolved that way before we started fishing.) The result is often that fast growing fish are culled out of a population, resulting in lower numbers of fish, but also leaving the slow growing fish to reproduce the next generation.

So the runts become the bulk of the gene pool and over time the maximum size of the fish is reduced. But most people don't realize the difference because the time it takes to see that kind of change. To them, the fish were always that smaller size.

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